CLAIMS

What is claimed is:

1. A method for repairing a coated component, which has been exposed to engine operation, to restore coated dimensions of the component and increase subsequent engine operation efficiency, comprising:

a) providing an engine run component including a base metal substrate having thereon a thermal barrier coating system, the thermal barrier coating system comprising a bond coat on the base metal substrate and a top ceramic thermal barrier coating, the top ceramic thermal barrier coating having a nominal thickness t;

b) removing the thermal barrier coating system, wherein a portion of the base metal substrate also is removed, and determining thickness of the base metal substrate removed, the portion of the base metal substrate removed having a thickness, Δt;

c) applying a β phase NiAl overlay coating to the substrate, and determining the difference in thickness, Δx, between the β phase NiAl overlay coating and the bond coat previously removed;

d) reapplying a top ceramic thermal barrier coating to a nominal thickness of $t+\Delta t-\Delta x$, wherein Δt compensates for the portion of base metal substrate removed in b), and the dimensions of the coated component are restored to about the coated dimensions preceding the engine run to increase subsequent engine operation efficiency.

2. The method of claim 1, wherein the engine run component is a high pressure turbine blade, and coated airfoil contour dimensions of the coated component are restored.

3. The method of claim 1 further comprising the step of weighing the component after step c) and calculating Δt to be applied in step d).

4. The method of claim 1, wherein t is between about 3 mils and about 10 mils, and Δt is at least about 0.5 mil.

5. The method of claim 1, wherein the bond coat of a) comprises a diffusion aluminide coating.

6. The method of claim 5, wherein the diffusion aluminide coating is a simple aluminide or a modified aluminide.

7. The method of claim 1, wherein the base metal substrate is a nickel-based single crystal superalloy.

8. The method of claim 1, wherein the base metal substrate is a nickel-based directionally solidified superalloy.

9. The method of claim 5, wherein the diffusion aluminide coating is a modified aluminide coating comprising a metal selected from the group consisting of Pt, Rh and Pd.

10. The method of claim 5, wherein the diffusion aluminide coating further comprising reactive elements.

11. The method of claim 1, wherein the ceramic thermal barrier coating comprising yttria stabilized with zirconia.

12. The method of claim 1, wherein the bond coat of a) comprises a MCrAlY coating.

13. The method of claim 1, wherein the β NiAl overlay coating comprises a NiAl alloy consisting essentially of nickel and aluminum and containing zirconium.

14. The method of claim 1, wherein the β NiAl overlay coating is applied to a thickness of about 0.5-2 mils.

15. The method of claim 13, wherein the alloy comprises at least about 0.2 atomic percent of the zirconium.

16. The method of claim 1, wherein the β NiAl overlay coating comprises about 2-15 atomic percent chromium and about 0.1-1.2 atomic percent zirconium.

17. The method of claim 1, wherein the β NiAl overlay coating further comprises reactive elements.

18. The method of claim 17, wherein the reactive elements are selected from the group consisting of Hf, Zr and Y.

19. A method for repairing a coated high pressure turbine blade, which has been exposed to engine operation, to restore airfoil contour dimensions of the blade comprising:

a) providing an engine run high pressure turbine blade including a base metal substrate made of a nickel-based alloy having thereon a thermal barrier coating system, the thermal barrier coating system comprising a diffusion bond coat on the base metal substrate and a top ceramic thermal barrier coating comprising a yttria stabilized zirconia material, the top ceramic thermal barrier coating having a nominal thickness t;

b) removing the thermal barrier coating system, wherein a portion of the base metal substrate also is removed, and determining thickness of the base metal substrate removed, the portion of the base metal substrate removed having a thickness, Δt;

c) applying a β phase NiAl overlay coating to the substrate, and determining the difference in thickness, Δx, between the β phase NiAl overlay coating and the previously removed bond coat,

d) reapplying the top ceramic thermal barrier coating to a nominal thickness of $t+\Delta t-\Delta x$, wherein Δt compensates for the portion of base metal substrate removed in b), and the coated airfoil contour dimensions of the coated blade are restored to about the coated dimensions preceding the engine run.

20. The method of claim 19, wherein the nickel-based alloy has a density of about 8.64 g/cm^3.

21. The method of claim 19, wherein the yttria stabilized zirconia material has a density of about 4.7 $g.cm^3$.

22. The method of claim 1, wherein the component is an airfoil.

23. The method of claim 1, wherein the component is a static component.

24. The method of claim 23, wherein the static component is a vane.

25. A method for repairing a coated component, which has been exposed to engine operation, to restore coated airfoil contour dimensions of the component comprising:

a) providing an engine run component including a base metal substrate made of a nickel-based alloy having thereon a thermal barrier coating system, the thermal barrier coating system comprising a diffusion bond coat on the base metal substrate and a top ceramic thermal barrier coating comprising a yttria stabilized zirconia material, the top ceramic thermal barrier coating having a nominal thickness t;

b) inspecting the component;

c) removing the thermal barrier coating system by stripping, wherein a portion of the base metal substrate also is removed, the portion of the base metal substrate removed having a thickness, Δt;

d) applying a β phase NiAl overlay coating to the substrate and determining the difference in thickness Δx between the β phase NiAl overlay coating and the previously removed bond coat; and weighing the component to calculate Δt;

e) reapplying the top ceramic thermal barrier coating to a nominal thickness of $t+\Delta t-\Delta x$, wherein Δt compensates for the portion of base metal substrate removed in b), and the airfoil contour dimensions of the coated component are restored to about the coated dimensions preceding the engine run.